

Chapter 7. Displaying, Modifying and Mapping Inventories

Chapter 6 discussed how to enter data and import databases. Once your data is entered into **HAZUS**, you have a number of options available for displaying and modifying the data.

7.1 Editing a Database

Data within a database can be edited by double clicking on the spreadsheet cell containing the data you want to change. Highlight the text you wish to modify and your typing will replace the highlighted text.

7.2 Printing Out a Database

All databases can be printed out using the **Print** button at the bottom of the window.

7.3 Modifying Occupancy to Model Building Type Relationships

From the **Inventory|General Building Stock|Occupancy Mapping...** menu a spreadsheet, such as the one shown in Figure 7.1, will appear. In this particular example the default mapping shown is for a ‘Low seismic’ design level.

The design level designation is tied to the damageability of a structure reflected in the damage functions (fragility curves). Fragility curves are discussed in Chapter 9 of this manual and in the *Technical Manual*. The design levels correspond to map areas in the document *NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings* (FEMA, 1991a). High seismic design corresponds to map area 7, moderate seismic design to map areas 5 and 6, and low seismic design to map areas 1 through 4.

Each row of the spreadsheet represents an occupancy class and each column represents a model building type. For this example, low-rise construction (RES3) consists of 73% W1, 2% S3, 3% S4L, 6% C2L, 1% C3L, 1% PC2L, 9% RM1L and 5% MH (see Table 3A.4 of the *Technical Manual*). Many of the model building types are not visible in Figure 7.1, but can be seen by scrolling to the right on your screen. The sum of the percentages of the model building types for each occupancy class is found in column 2 of the spreadsheet, entitled “Total”.

It should be noted that three default occupancy-to-model-building-type mapping schemes have been developed (West Coast, Mid-West and East Coast) and are found in Appendix 3A of the *Technical Manual* for general building stock and Appendix 3B for essential facilities. Appendix 3C summarizes which of these three groups is identified with each of the fifty states. Finally, it should be noted that at the present time the mapping schemes for Pre-1950, 1950-1970, and post-1970 differ only in the West Coast region.

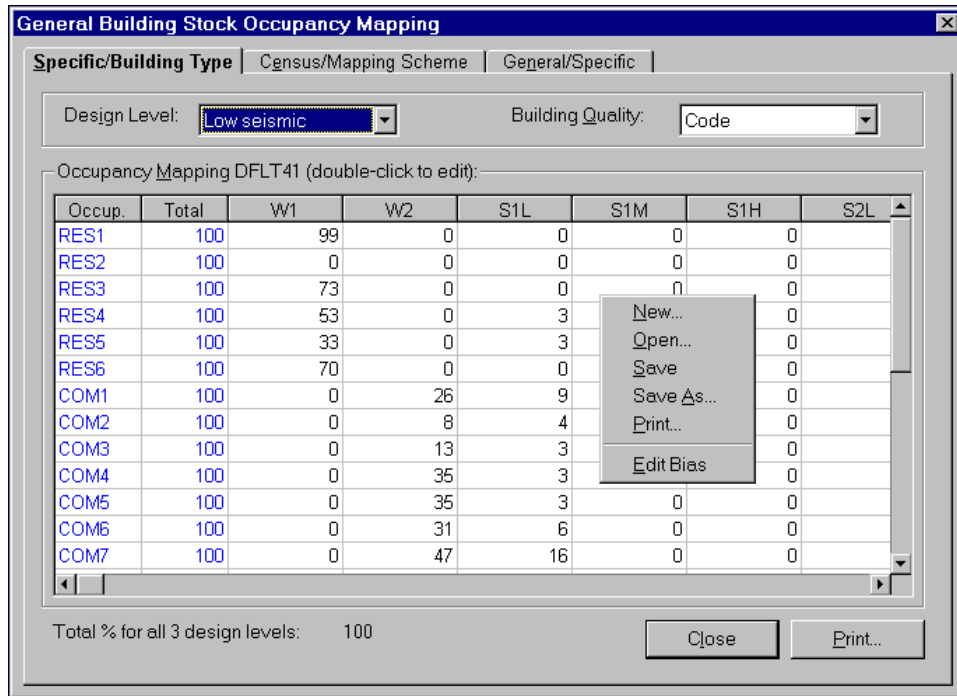


Figure 7.1 Window displaying a specific occupancy to model building type mapping scheme

The data management menu shown in Figure 7.1 allows you to open other mapping schemes if they exist. Using the right mouse button, click anywhere on the spreadsheet to access the data management menu. Click on **Open...** and the dialog box shown in Figure 7.2 will appear. This dialog box shows you all of the occupancy to model building type mapping schemes that have been defined for your region. In this example, two default schemes are available: DFLT41 and DFLT41L. The description of the mapping scheme (in this case, “Oregon State (Default)”) can be seen in the lower portion of the window.

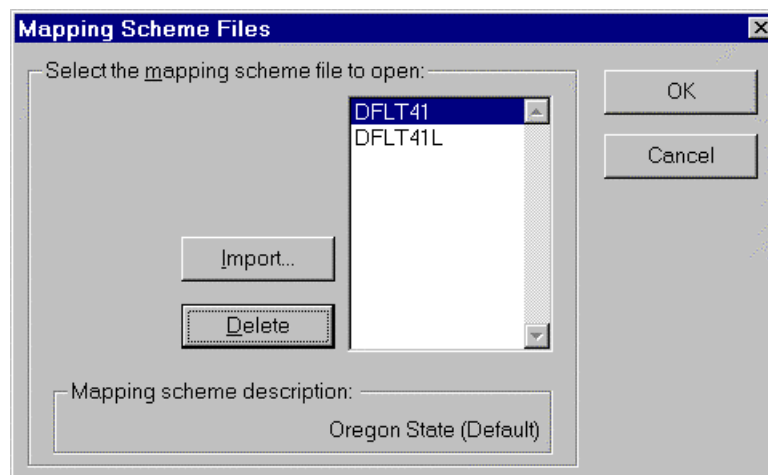


Figure 7.2 Selecting a model building type to occupancy mapping scheme

To view a scheme, highlight the file name of that mapping scheme and click on **OK**.

7.3.1 Modifying the Mix of Age and Building Heights

The default occupancy to building type mapping is based upon a default mix of ages and heights. The default mapping scheme varies by state and is displayed when the user opens the window displayed in Figure 7.1. It is possible that different census tracts within the study region will have different age and height mixes. A downtown area might have a large percentage of high-rise structures, whereas a residential area may not. To override the default the user can use the New Mapping Scheme Parameters window shown in Figure 7.4.

As an example of the use of the New Mapping Scheme Parameters menu, suppose you determined that 50% of the buildings in a census tract were low-rise and 50% were mid-rise, and that 50% of the buildings were built before 1950, 30% between 1950 and 1970 and 20% after 1970. Before you modify your mapping scheme, you should save it under a new name by clicking on the right button of your mouse and selection the **Save As** option shown in Figure 7.1. Clicking the right mouse button with the pointer positioned over the spreadsheet accesses the data management menu. After typing a new name (for this example - NEWMIX) and a description of the mapping (see Figure 7.3) click on the **OK** button.

Figure 7.3 Saving a mapping scheme under a new name


Clicking on the right mouse button anywhere in the cells table and choosing the option New as shown in Figure 7.1 can create the New Mapping Scheme Parameters window. Once the age and height percentages have been set as shown in Figure 7.4 and you have clicked the **OK** button, a new occupancy mapping automatically will be calculated. You will be asked to confirm that you want to overwrite the mapping scheme (see Figure 7.5). Click **OK** and you will be presented with the modified mapping shown in Figure 7.6. A detailed discussion of how age and height are used to modify the mapping scheme is found in Section 4.5. It is important to keep in mind that changing the age distribution only changes the percentages of building types. It does not change the design level. Change the design level by using the **Edit Bias** option (Section 7.3.2).

New Mapping Scheme Parameters (%)

Age:		Height:		OK	Cancel
Pre-1950:	50	Low-rise (1-3 stories):	50		
1950 to 1970:	30	Medium-rise (4-7 stories):	50		
Post 1970:	20	High-rise (8+ stories):	0		
Building Quality (Bias):		Design Level:			
Code:	25	Low seismic:	100		
Inferior:	75	Moderate seismic:	0		
Superior:	0	High seismic:	0		

Figure 7.4 New mapping scheme parameters window

HAZUS

 The new age, height and quality bias values will generate a new mapping scheme file. Do you want to overwrite the current one?

Yes No

Figure 7.5 Confirmation window for overwriting a mapping scheme

General Building Stock Occupancy Mapping

Specific/Building Type | Census/Mapping Scheme | General/Specific

Design Level: Low seismic | Building Quality: All types

Occupancy Mapping: NEWMIX (double-click to edit):

Occup.	Total	W1	W2	S1L	S1M	S1H	S2L
RES1	100	99	0	0	0	0	0
RES2	100	0	0	0	0	0	0
RES3	100	36	0	0	6	0	0
RES4	100	22	0	3	7	0	0
RES5	100	14	0	2	6	0	0
RES6	100	26	0	0	10	0	0
COM1	100	0	11	2	6	0	0
COM2	100	0	5	2	7	0	0
COM3	100	0	10	1	7	0	0
COM4	100	0	14	1	13	0	0
COM5	100	0	14	1	13	0	0
COM6	100	0	10	3	9	0	0
COM7	100	0	15	5	10	0	0

Total % for all 3 design levels: 100

Close Print...

Figure 7.6 Mapping scheme modified to reflect user defined age mix

7.3.2 Modifying the Mapping Scheme to Reflect Different Design Levels

The bias refers to whether the structures are built to code, are superior to the code or inferior. The default is that 25% of buildings are built to code and 75% are inferior. The bias is described in detail in Section 5.7 of the *Technical Manual*. The *default* bias should be used unless you have an in-depth understanding of building practices in your region.

HAZUS gives you the option to define a mix of design levels for each model building type. A mix of design levels can occur when structures are built at different times and are designed under different codes. The damage functions provided in the damage module are based on current NEHRP provisions (FEMA, 1991a) and are intended to represent current code provisions. Damage functions are developed for each of three seismic design regions, defined in terms of the 1994 NEHRP Provisions map areas: High Seismic Design (Map Area 7), Moderate Seismic Design (Map Areas 5 and 6), and Low Seismic Design (Map Areas 1 to 4).

In those regions that have not enforced seismic design codes or have a number of buildings that do not meet current standards, the damage functions may under-predict damage. In contrast, the damage functions may over-predict damage for buildings that are designed/constructed for performance beyond code requirements. The latter case is not expected to include a large population of buildings and is not expected to affect regional damage/loss estimation. The year when seismic provisions were included in building codes varies by region. The user should consult a local structural engineer or the local building departments to determine what year seismic design provisions were enforced. Section 5.7 of the *Technical Manual* and FEMA publication 154 provide some general guidelines for different regions of the United States.

Users may tailor the damage functions to their study area of interest by determining the appropriate fraction of each building type that conforms essentially to current code provisions (for example, High in California, Moderate and Low in Florida) and the fraction that is substandard by a significant degree. Buildings that are considered significantly substandard would be assigned a lower seismic design group. For instance, certain types of older buildings in Map Area 7 should be evaluated using damage functions for Map Areas 5 & 6. Such buildings would include concrete moment frames (Building Type C1) on the west coast built prior to the mid-1970s. Buildings over 60 years old were likely designed only for wind and at least a portion of these older buildings may best be evaluated using the damage functions developed for Map Areas 1-4. To modify defaults, users must be knowledgeable about the type and history of construction in the study region of interest and apply engineering judgment in assigning the fraction of each building type to a seismic design group.

To clarify how to develop an occupancy mapping to reflect different design levels, assume that a census tract within the study region has a mixture of construction so that the RES1 occupancy mapping is as shown in Table 7.1. In this example, 73% of all single-family dwellings (RES1) are low-rise wood frame (W1), 5% are steel light frame (S3) and so on. Although this census tract is in a high seismic region, some of the structures were built before seismic design criteria were adopted. Thus 50% of all RES1 are seismically designed W1, 15% are moderate seismic W1 and 8% are low seismic W1.

An example of a low seismic construction would be a house with an unbraced cripple wall. All building types that are not shown in Table 7.1 are not present in the hypothetical census tract. For any occupancy class, the model building type percentages across all design levels must add to 100%. This is checked and indicated in the lower right-hand corner of the table.

Table 7.1 Sample occupancy mapping for RES1 (single-family dwelling)

Design Level	Model Building Type						
	W1	S3	S4L	RM1L	URML	MH	
High Seismic	50%	5%	3%	3%	0%	2%	Sum = 63%
Moderate Seismic	15%	0%	0%	3%	0%	0%	Sum = 18%
Low Seismic	8%	0%	0%	3%	5%	3%	Sum = 19%
Total Percent	73%	5%	3%	9%	5%	5%	Sum = 100%

You would enter this mapping scheme in row one of the window shown in Figure 7.2 by toggling between design levels with the **Design Level** menu and entering the appropriate values for each design level. The result is shown in Figure 7.7. Note in Figure 7.7 that the total RES1 in the high seismic design level is 63%. However the sum of all three RES1 design level totals is 100%. If the total for all design levels is not 100%, you will be given an error message when you try to save the mapping.

General Building Stock Occupancy Mapping

Specific/Building Type | Census/Mapping Scheme | General/Specific

Design Level: High seismic | Building Quality: Code

Occupancy Mapping: DFLT06H (double-click to edit):

Occup.	Total	W1	W2	S1L	S1M	S1H	S1
RES1	63	50	0	0	0	0	
RES2	0	0	0	0	0	0	
RES3	0	0	0	0	0	0	
RES4	0	0	0	0	0	0	
RES5	0	0	0	0	0	0	
RES6	0	0	0	0	0	0	
COM1	0	0	0	0	0	0	
COM2	0	0	0	0	0	0	
COM3	0	0	0	0	0	0	
COM4	0	0	0	0	0	0	
COM5	0	0	0	0	0	0	

Total % for all 3 design levels: 100

Close Print...

Figure 7.7 Mapping scheme modified to reflect different design levels

7.4 Defining Different Mapping Schemes for Different Census Tracts

The user can create a series of occupancy mappings by modifying the default values and saving the different mapping schemes under different filenames (filename is in upper left portion of the spreadsheet in Figure 7.7). Different mapping schemes can then be assigned to different census tracts. The reason the user may wish to create different mapping schemes is that building practices may vary throughout the study region. For example, in an older area 30% of the retail buildings (COM1) may be low rise unreinforced masonry (URML), while in more recently developed areas, only 5% of COM1 may be of model building type URML.

Once a series of occupancy mapping schemes have been defined and saved using the right button mouse click **SAVE AS** option, you can then assign schemes to each census tract. This is done using the window shown in Figure 7.8. In this example, two mapping schemes have been defined (the default mapping and the new mapping that includes age and height mix). Initially, upon entering this window, all census tracts will be assigned the default mapping scheme for their particular state. You can override the default by clicking on the row number for a census tract and then double clicking on the desired mapping scheme. When you close this window, you will be asked to confirm your changes.

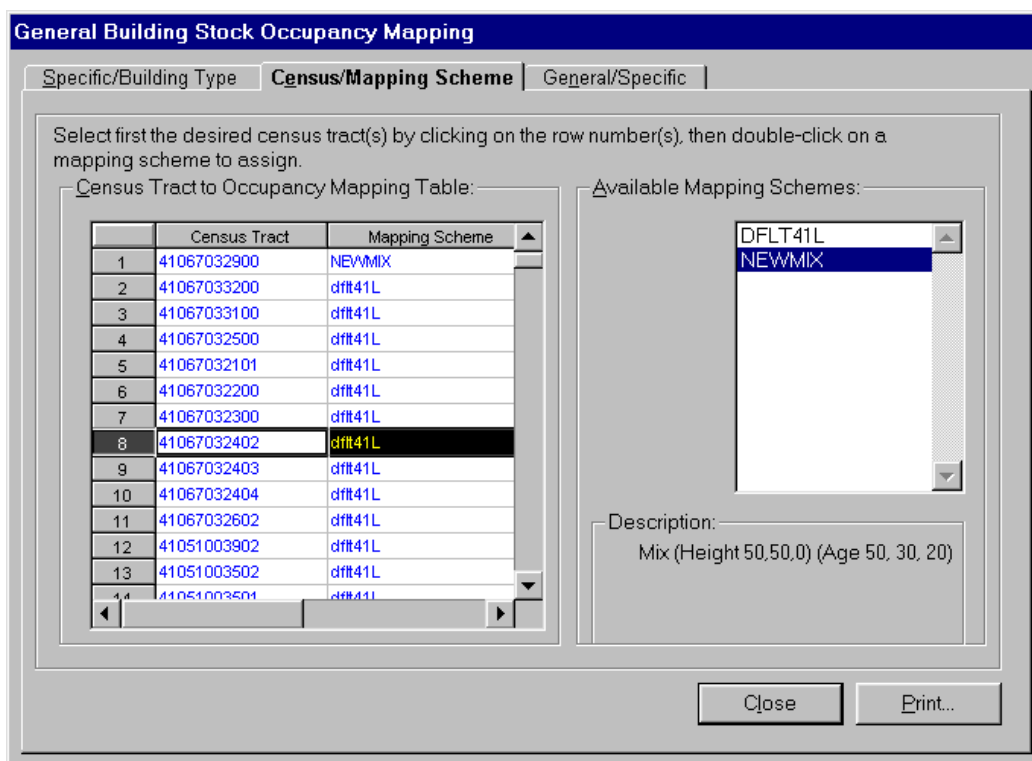


Figure 7.8 Occupancy mapping scheme assignment window

7.5 General to Specific Occupancy Mapping

You have the option to modify the distribution of specific occupancies within each general occupancy class. Within the general occupancy class Residential, there are six

specific occupancy classes as summarized in Table A.3 in appendix A. An example of the distribution of residential occupancies is shown in Figure 7.9. In this window, it is shown that for census tract 41005020600 89% of residential construction is RES1, 0% is RES2, 11% is RES3, and 0% is RES4, RES5, and RES6. Within each general occupancy class (residential, commercial, industrial, agriculture, religion/non profit, government and education) the specific occupancies must sum to 100%. Default distributions are provided in **HAZUS**. These defaults are based on the 1990 Census and 1996 Dun and Bradstreet Data. Modifications to the defaults cannot be made in the window shown in Figure 7.9 and must be made by changing the dollar exposure values in Figure 7.10. This window is accessed from the **Inventory|General Building Stock| Square Footage** menu.

Occupancy	Percentage
RES1	89.39
RES2	0.00
RES3	10.61
RES4	0.00
RES5	0.00
RES6	0.00
COM1	27.84
COM2	18.90
COM3	10.60
COM4	26.29
COM5	4.30
COM6	0.00
COM7	3.04
COM8	9.05
COM9	0.00
COM10	0.00
IND1	61.55

Figure 7.9 General to specific occupancy mapping scheme

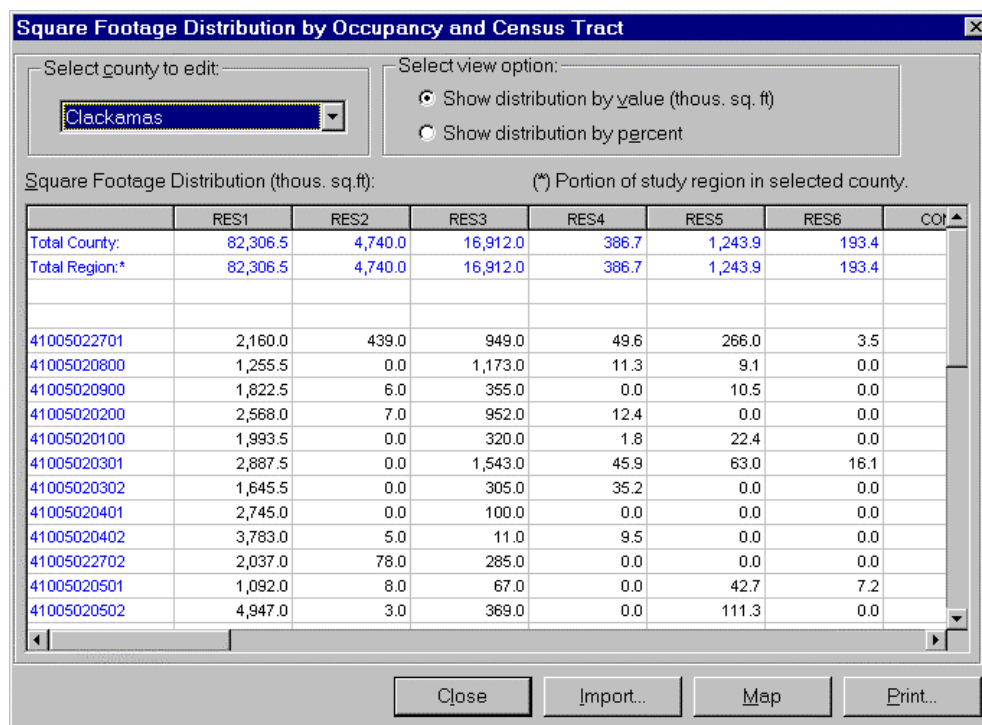


Figure 7.10 Square footage per census tract and occupancy.

7.5.1 Mapping a Database

All databases can be mapped using the **Map** button at the bottom of the window. MapInfo tools can be used to modify legends and to bring different layers to the front. Entries in site-specific databases, such as emergency facilities and lifeline components, will appear as symbols on the map. Other types of databases such as census data, soil types, and general building stock inventory, are displayed as thematic maps. In thematic maps, shading or colors are used to display attributes of a particular region. For example hatching represents areas with dense population and dotting represents areas with less dense population as shown Figure 7.12.

7.5.1.1 Modifying the Ranges of a Thematic Map

When you click on the **Map** button at the bottom of a database window, a thematic map will be displayed using default setting for the ranges and colors of data. It is very simple to customize the look of a map to meet your own needs. The following is an example of the procedure to customize a population data map.

1. Select the **Inventory|Demographics** menu option and the table shown in Figure 7.11 will appear. The database contains many attributes that can only be mapped one at a time. In order to map the population information, click on the word *Population* to highlight that column of the database. Click on the **Map** button and the map in Figure 7.12 will be generated.

Demographics

Table:

	Census Tract	Population	Households	Group Quarters	Pop. age < 16
33	41005020100	3,851	1,629	32	777
32	41005020200	5,648	2,563	0	983
34	41005020301	7,744	3,262	90	1,610
35	41005020302	3,286	1,350	0	715
36	41005020401	5,200	1,956	0	1,253
37	41005020402	7,433	2,450	0	1,961
171	41005020501	2,377	798	61	666
172	41005020502	10,138	3,621	159	2,597
173	41005020600	5,387	1,988	0	1,410
174	41005020700	2,784	996	0	761
25	41005020800	3,738	1,921	13	562
26	41005020900	3,703	1,563	15	844
190	41005021000	4,396	1,737	0	937
182	41005021100	5,356	2,031	79	1,279
183	41005021200	3,782	1,915	158	583
184	41005021300	5,551	2,149	0	1,232
185	41005021400	4,275	1,654	29	854
186	41005021500	4,185	1,652	0	842
191	41005021601	4,221	1,714	11	1,096
181	41005021602	4,041	1,582	0	883
175	41005021700	4,001	2,017	14	1,096

Close Map Print..

Figure 7.11 Highlighting the population column of the population inventory

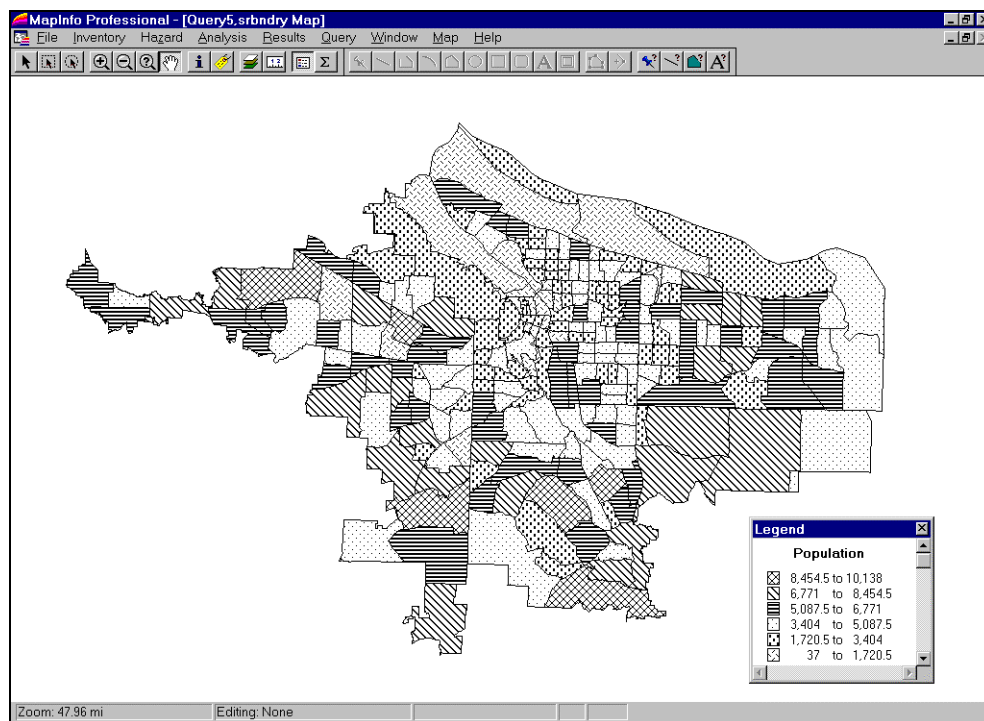


Figure 7.12 Thematic map of population including modifications described in Section 7.5.1.2

- To change the ranges of the thematic map, double-click anywhere in the legend of Figure 7.12 and the window shown in Figure 7.13 will appear. Click on the **Ranges** button.

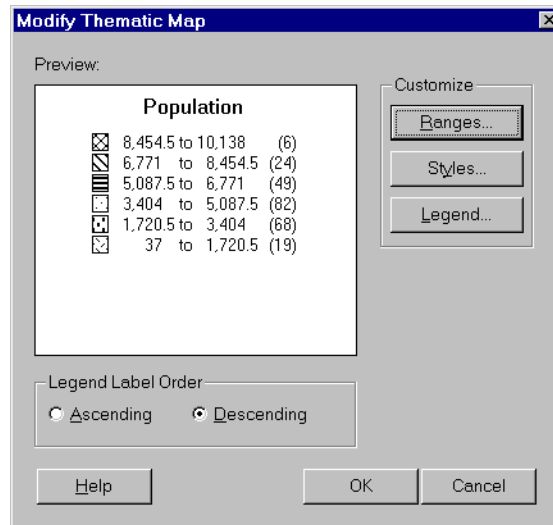


Figure 7.13 Window used to modify the display characteristics of a thematic map

3. The **Customize Ranges** window shown in Figure 7.14 allows you display your data in a variety of ways. For example, you can divide the data into as many or as few ranges as you wish, you can round the data, you can display the records by equal count so that there are approximately the same number of records in each range or you can display by equal range so that each range represented for example a span of 500. There are many other options. For this example select the Natural Break method, 6 ranges, and round by 1000, then click the **Recalc** button. If you are satisfied with the new range definition, click **OK** (Figure 7.14) followed by **OK** on the **Modify Thematic Map** window (Figure 7.15). A map as shown in Figure 7.16 will appear which reflects the range changes.

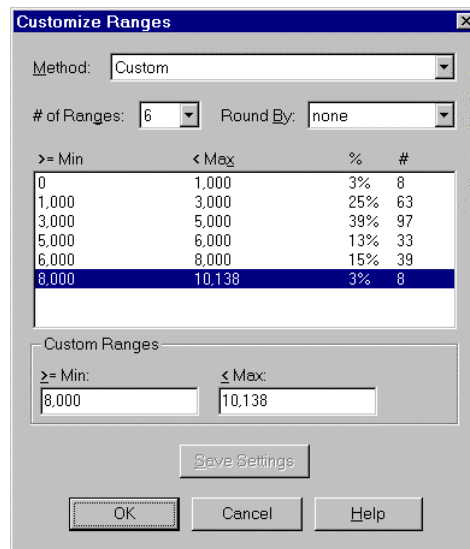


Figure 7.14 New ranges which are displayed after making modifications

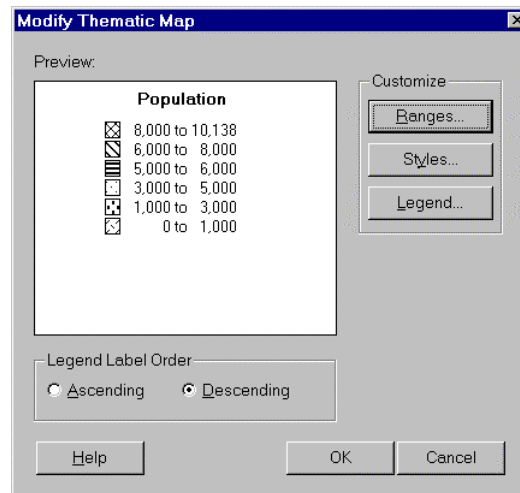


Figure 7.15 Preview of new legend after customizing display ranges

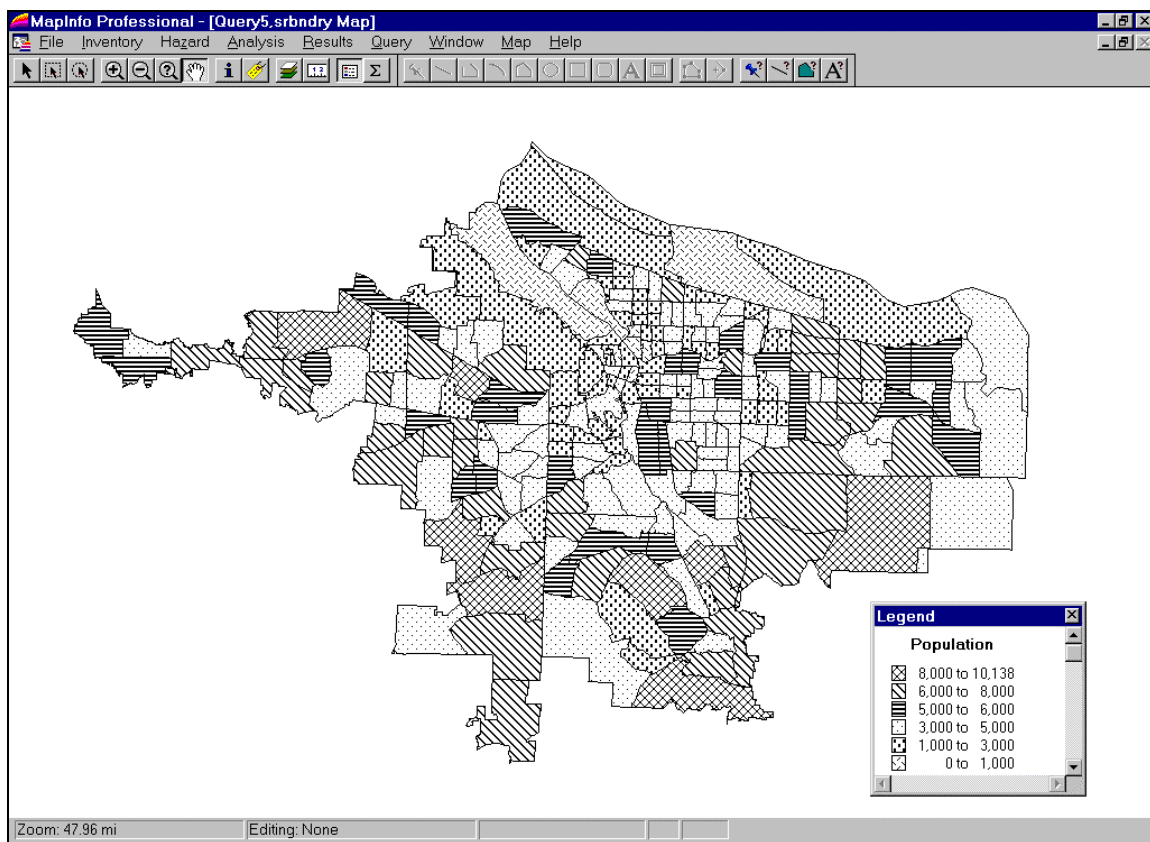


Figure 7.16 Thematic population map that reflects modifications to the range definitions

7.5.1.2 Modifying the Style of a Thematic Map

Colors of a thematic map can be modified and ranges can also be represented in black and white using different patterns. To change the colors of the thematic map in this example, use the following procedure:

1. Double-click anywhere in the legend box. The **Modify Thematic Map** box shown in Figure 7.17 will appear.

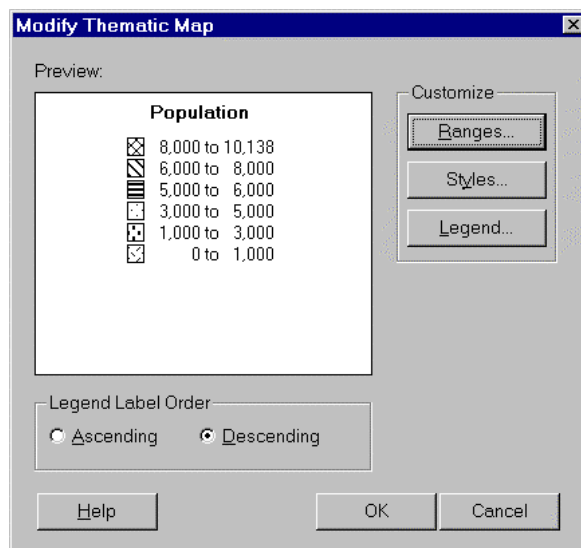


Figure 7.17 Window used to modify the display characteristics of a thematic map

2. Click on the **Styles** button and the **Customize Range Styles** dialog will appear as shown in Figure 7.18. The colored buttons relate to the defined ranges. To change the color or pattern for a range, click on the colored button corresponding to that range. The **Region Style** window shown in Figure 7.19 will appear.

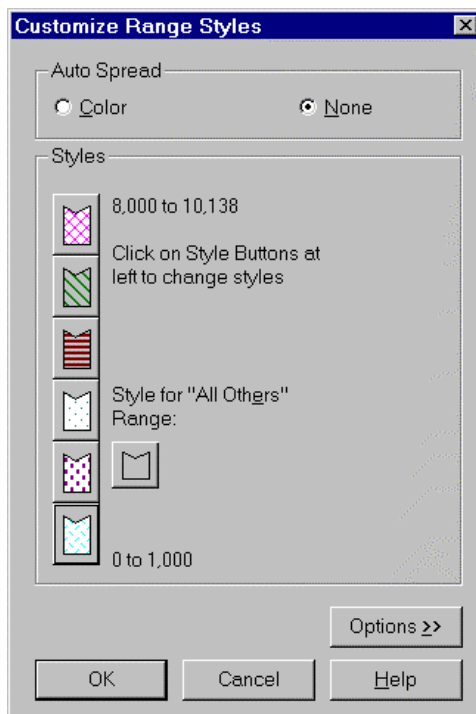


Figure 7.18 Window used to modify colors or patterns for each defined range

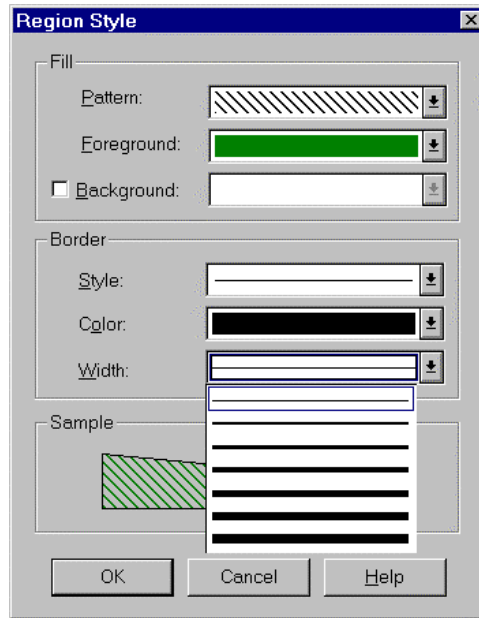


Figure 7.19 Selecting a line width in the region style window

3. Define the **Fill** and **Border** using the pull down menus. Note that the Background option in the **Fill** box will be grayed out unless you select something other than a solid pattern. When “None” is selected for the fill pattern, the layer will be transparent and the layer underneath will be displayed. When you are satisfied with the style shown in the **Sample** box at the bottom of the window, click **OK**. Repeat this procedure for each range. When finished, click **OK** in the **Customize Range Styles** window (Figure 7.18). Then click **OK** in the **Modify Thematic Map** window (Figure 7.20) and the map in Figure 7.21 will be displayed.

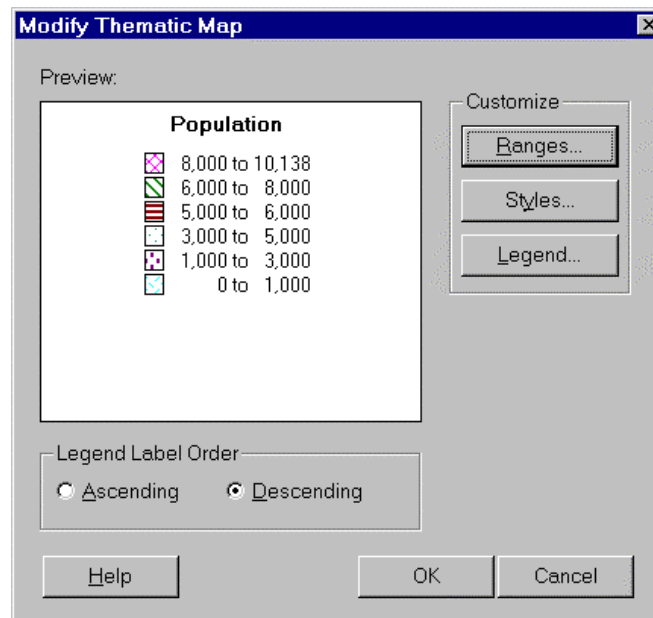


Figure 7.20 Preview of new legend after customizing display styles

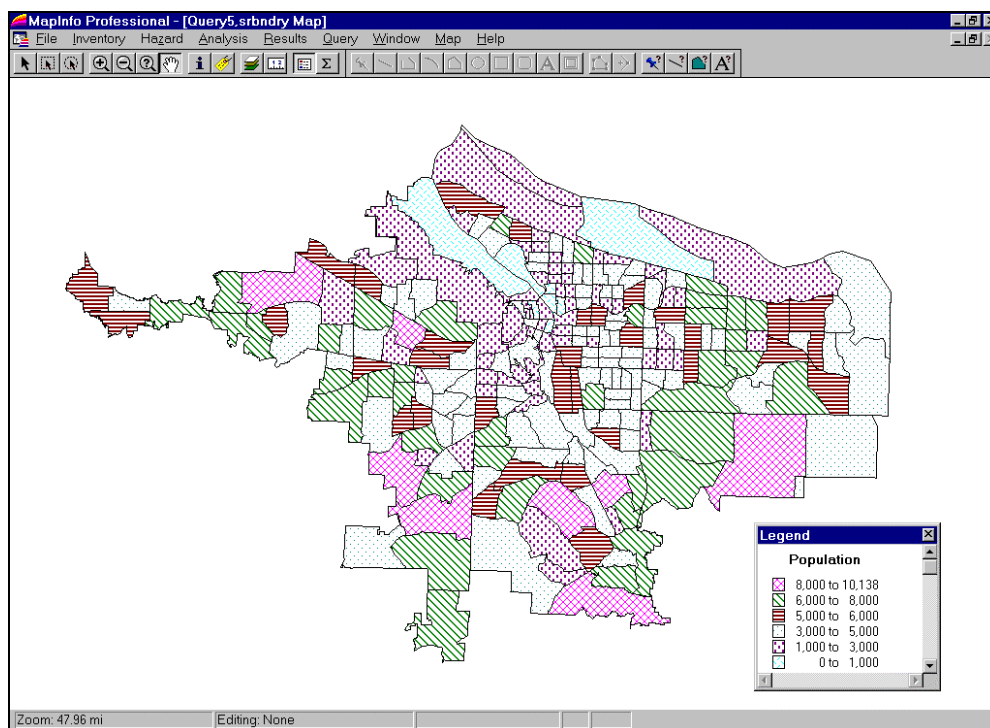


Figure 7.21 Thematic population map that reflects modifications to the range styles

7.5.1.3 Creating a Layout Window and Printing Maps

Layout windows are used to format maps for printing.

1. Select the **Window|New Layout Window** menu option.
2. **HAZUS** automatically generates the Layout window shown in Figure 7.22. When **HAZUS** first opens the layout, it sets the page size and orientation according to the current settings for your printer. For example, in Figure 7.22 the page was set to 8.5 X11 inches and landscape orientation. To change these settings, use the Page Setup menu shown in Figure 7.26 that can be accessed by going to **File|Print Setup**. You can resize the layout window using your mouse by clicking on and dragging the border of the layout window. If the map seems too small, use the “zoom in” tool from the **Main** tool menu to enlarge it.

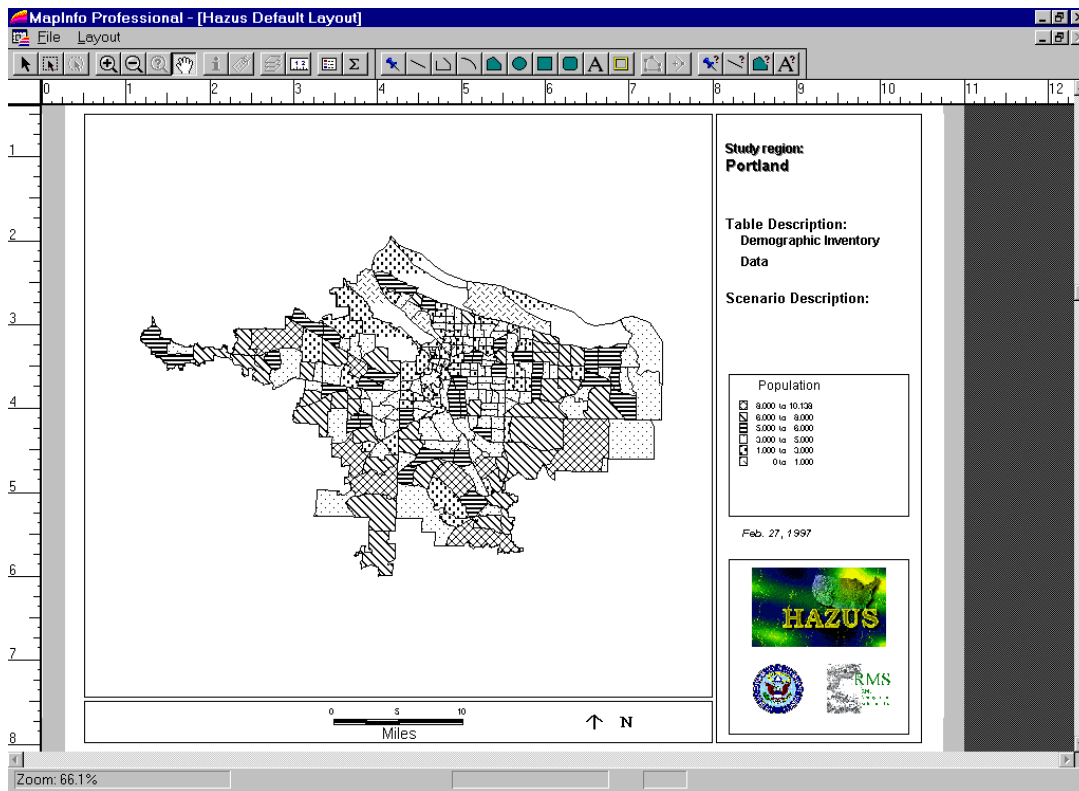


Figure 7.22 Layout window, used to modify a map for printing

4. To create a title or other labels, select **A** from the **Drawing** tool menu. Click on the desired map location and type the appropriate label. The location and font of the label may be changed after the text is entered. When completed, select the arrow cursor from the **Main** tool pad and double click on the label. The **Text Object** window, which is used to change the style of a label, will appear as shown in Figure 7.23. Clicking on the **Style** button will give you many options for text style as shown in Figure 7.24. The location of the label can be defined using X and Y values in the Text Object window or the cursor can be used to drag and drop the label. Text can be oriented at various angles using the Rotation Angle option. A positive angle causes the label to rotate counter-clockwise.

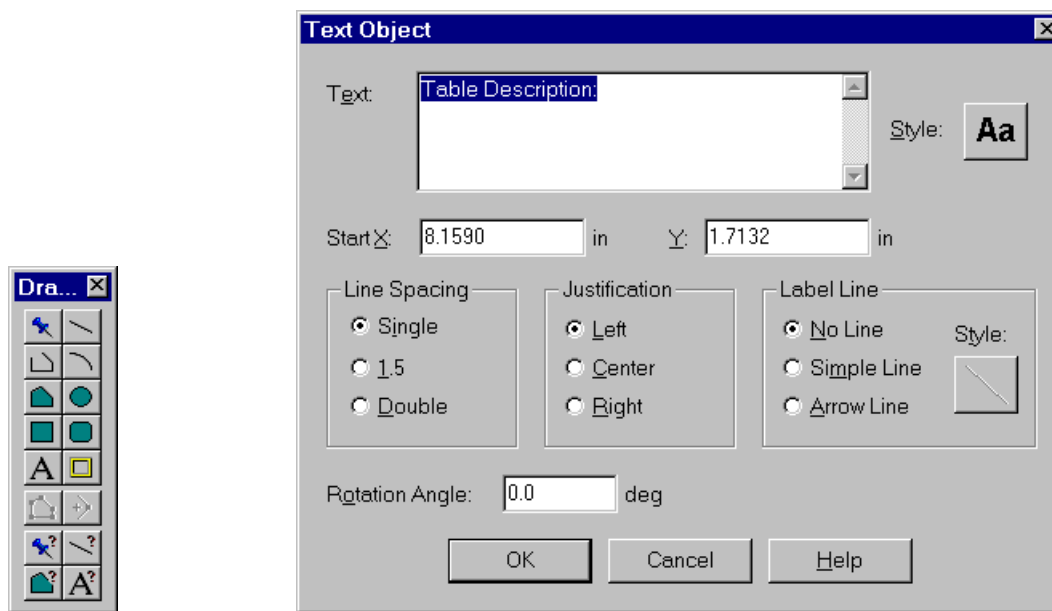


Figure 7.23 The Drawing tool menu and the Text Object window used to add and modify labels on a map

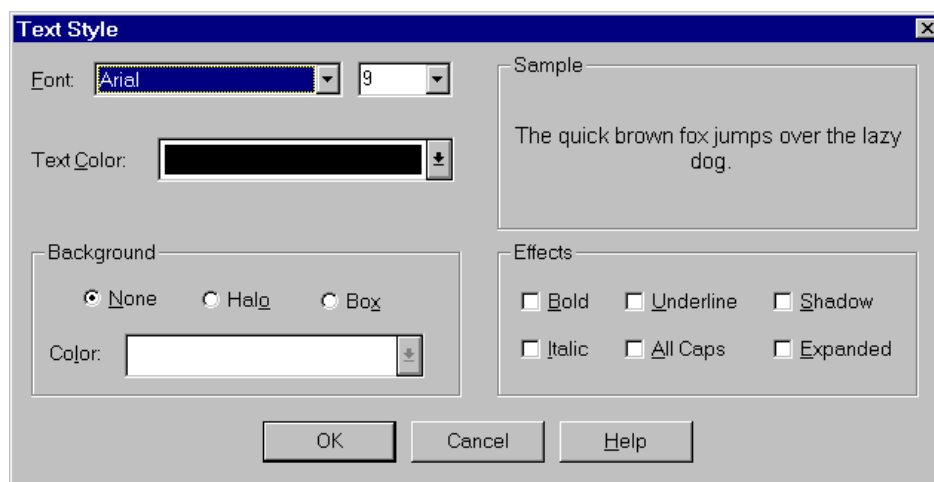


Figure 7.24 Window for defining style of text on layout

4. To adjust or resize the figure in the layout window, double click with the arrow on the figure in the layout window. The **Frame Object** window shown in Figure 7.25 will appear. Make adjustments as necessary. The X and Y bounds and coordinates move and rescale the map. Drag and drop can also be used to move the figure or the legend. Alternatively, the **Scale on Paper** can be used to establish a specific scale such as 10 miles equals 1 inch.

To change the map proportion in the layout, resize the original map using the Change View option or the zoom tools. MapInfo automatically transmits changes on the original map to the layout frame.

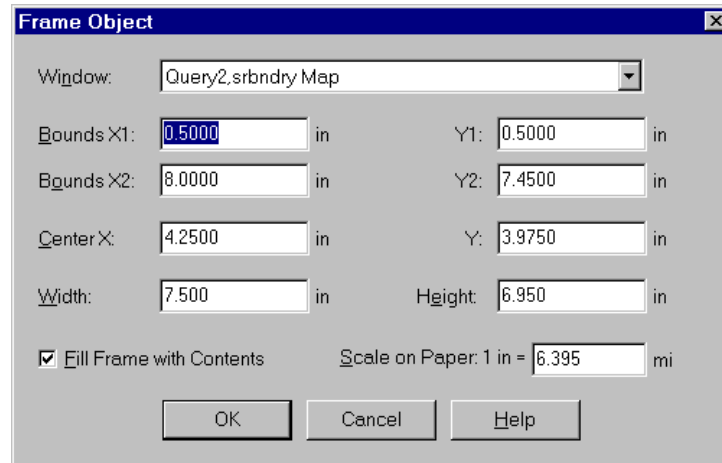


Figure 7. 25 Frame object window used to modify the size and location of a map in the layout window.

5. To set-up the printer, select the **File|Print Setup** menu option. The window shown in Figure 7.26 will appear. Adjust the settings as needed and click **OK**. To print, select the **File|Print** option shown in Figure 7.27. Click **OK** and the map is sent to the printer.

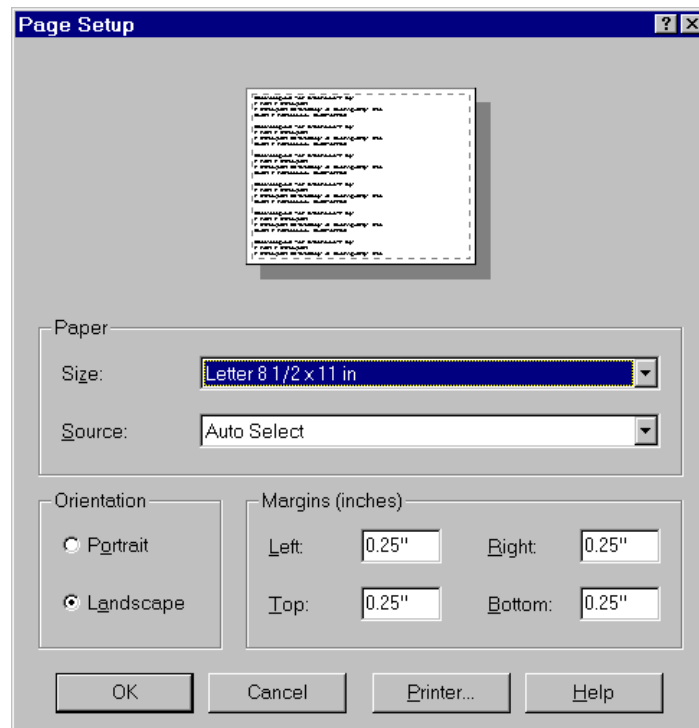


Figure 7.26 Page setup window for printing layouts

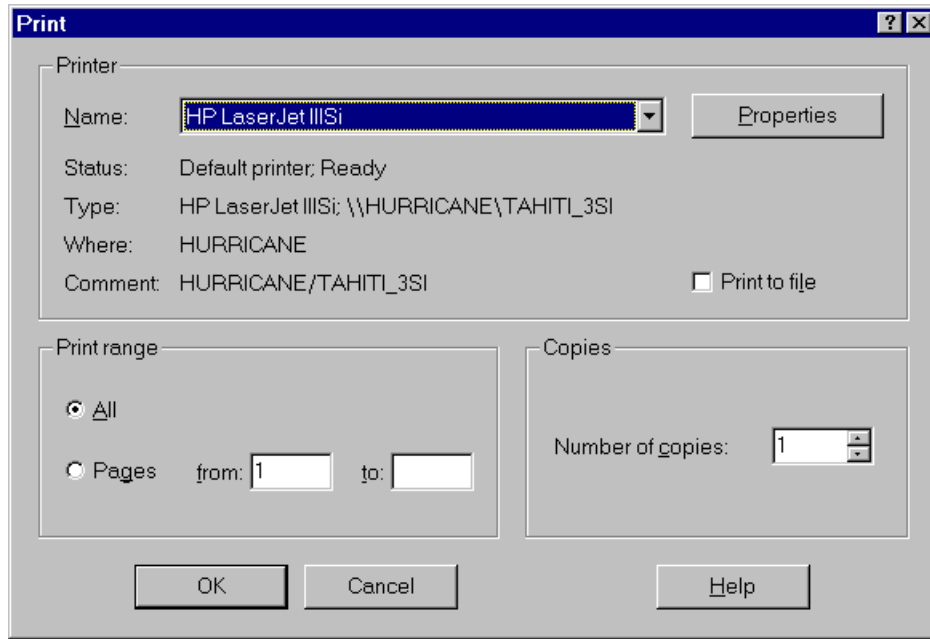


Figure 7.27 Print window for printing layouts

